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National Water Quality Monitoring Network: Reporting on Current Monitoring of Coastal Wetlands

Background Information Sources: California Rapid Assessment Method (CRAM) for Wetlands, National Wetlands Inventory (NWI) of US Fish and Wildlife Service, Coast-Wide Reference Monitoring System (CRMS) for wetlands along the Gulf of Mexico coast, Great Lakes Coastal Wetlands Consortium, National Academy of Sciences report "Compensating for Wetland Losses Under the Clean Water Act," and provisions of the Coastal Wetland Planning, Protection and Restoration Act.

Background

Even though much less in areal coverage than freshwater wetlands, coastal wetlands are extensive and can be found along all coasts of the United States. They support a large diversity of plants and animal species, provide essential habitats for numerous fish assemblages and wildlife populations, and perform important ecological functions that promote sustained water availability, high biological productivity, shoreline protection, and sequestration of certain pollutants. They are highly vulnerable to increasing human activities (e.g., harvesting, recreation, introduction of non-indigenous species) in the coastal zone and have suffered direct losses or adverse modifications due to dikes, channels, water diversions, etc.; as such, coastal wetlands are often described as the "fragile fringe." They are particularly vulnerable to changes in sediment accretion rates, coastal subsidence, and altered hydraulic configuration that may be exacerbated by sea-level changes, as has been documented for the middle Holocene period. Discerning the roles of climate change, inter-annual variations over the short-term, and changed directly induced by human activities has remained a daunting task for coastal managers.

Coastal wetlands come in a variety of forms and sizes and occur in areas with variable amounts of water sources and hydric soils. Even though, wetlands are understood to be "land that is wet" coastal wetlands have been defined in a number of different ways, often based on one or more salient features (for example, vegetation, soils, and hydrology). Thus the California Coastal Commission uses a "one parameter" definition (California Code of Regulations Title 14), the Army Corp of Engineers uses a "three parameter" definition (1987 Wetlands Delineation Manual), the U.S. Environmental Protection Agency has a distinctly different definition for purposes of implementing Section 404 of the Clean Water Act (40 CFR 232.2).

Complexity of wetland ecosystems, intense and increasing pressures of human activities in coastal watersheds and waterbodies, and different views on the wetland structure and function are significant impediments to creating a consistent suite of monitoring parameters and assessment techniques that could be applied widely, if not nationwide. Still, the best course of action for developing a coastal wetland monitoring strategy is a three-tiered approach, each having a different level of spatial resolution and scientific detail. Whereas the Tier-1 level observations may be most useful to decision-makers, those observations should be backed by scientific data and understand of the processes that culminate in landscape level (Tier-1) changes. Ideally, lower-tier indicators should be highly correlated (or associated with, if one is using multivariate statistical analyses) with Tier-1 indicators. Research data on such approaches are nearly non-existent.

Reporting by Pilot Studies

It is suggested that the Pilot Studies report on the gross levels of wetland-related monitoring and observational activities that are underway in their respective areas. For example, each pilot study area would be covered under national reporting on the status and trends of wetlands in the conterminous United States, as reported by the US Fish and Wildlife Service. Further, it is assumed that scientists and resource managers in each pilot study area have previously concluded or are currently engaged in monitoring and research to address the condition or ecological processes within their respective wetlands. It is expected that the scientific details of monitoring and research in each study area would be different; not all of the listed parameters needs to be checked off. For example, data on the following 8 wetlands indicators have been reported for the Great Lakes, each with a different state of completeness: Coastal Wetland Area by Type, Plant Communities Health, Invertebrate Community Health, Fish Community Health, Amphibian Diversity and Abundance, Wetland Bird Diversity and Abundance, Contaminants in Snapping Turtle Eggs, and Effect of Water Level Fluctuations. Each of these indicators can be categorized in one of the three tiers. Data on several other indicators, although considered, have not been reported for the Great Lakes.

National Reporting

It is generally understood that water quality-related monitoring of coastal wetlands is highly varied, both in terms of spatial scales and parameters. A systematic effort to develop a suited of key monitoring parameters is underway, in anticipation of a probability based survey of wetlands by the U.S. Environmental Protection Agency and its partners in 2011. A special session on coastal wetland monitoring at the 6th National Monitoring Conference (May 2008) is a step in that process. Once developed, the suite of measurements will be adopted by the National Water Quality Monitoring Network.

It is generally appreciated that a tiered approach to wetland monitoring – from landscape level reconnaissance to site specific measurements – will be most cost-effective. Examples of the types of measurements under a tiered approach are noted below.

Landscape Level – Tier I

NWI data as supplemented by region-specific observations from satellite or aerial reconnaissance

a) **Change in spatial coverage**
b) **Patch metrics; size and formation of interior ponds**
c) **Rotten spots / brown marsh / die-offs**
d) **Coastal watershed use (agriculture, urban, etc.)**
e) Topographic complexity
f) Change in percent impervious cover [from the Biology indicators]
g) Change in vegetative covering [kinds and amounts]
h) Estimates of culm heights and biomass
i) Canopy thinning
j) Channel enlargements

Rapid Assessment – Tier 2 [field testing of "visible indicators" by trained personnel]

a) Water availability [floods, droughts, diversions, impoundments]
b) Extent of Hydric soil
c) Habitat loss
d) Recreation / harvest

e) Habitat restoration
f) Invasive species
g) Parasitic infestations
h) Gross pollution

Intensive Observations – Tier 3 [detailed, laboratory based measurements focusing on a particular wetland]

a) Soil / sediment characteristics [grain size, bulk density, organic carbon, toxic chemicals and trace elements, etc.]
b) Porewater characteristics [salinity, dissolved organic and inorganic nitrogen and phosphorus]
c) Channel water characteristics [tide range, salinity, temperature, pH, dissolved oxygen, chlorophyll, dissolved organic and inorganic nitrogen and phosphorus, suspended particulate matter characteristics]
d) Primary producers [dominant vegetation, chlorophyll and estimated productivity, percent native species, and amount harvested]
e) Habitats and biological community structure [bird census, fish assemblages, animal scat surveys, habitat affinities of "signature" species, indicator parasites (for example, trematodes), ecological process indicators (for example, production: biomass ratio, biomass-size spectra, trophic structure, carbon-nitrogen-phosphorus ratios (for example, Redfield ratio and Atkinson ratio), carbon source identification (e.g., isotopic signatures), species-abundance-biomass or SAB relationships), etc.]